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HD **Canada's glaciers are in danger**
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With glacial peaks in peril the world over, experts say collective action is needed now

A record-breaking drought in southern British Columbia in 2022 was deadly for Pacific salmon, leaving dried-up riverbanks thick with carcasses.

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Many more fish were unable to make their way up to their spawning beds during their peak migration time. The magnitude of the losses won't be known for years.

For rivers fed by Western Canada's immense array of glaciers, however, there was salvation.

Seasonal runoff from glaciers in summer provides a clean, cool and reliable flow.

But the buffer that glaciers provide against increasingly extreme weather patterns is on the clock, and time is running out.

A research paper published Thursday in the journal *Science* charts the impact of a warming planet on every glacier on the planet, predicting that half the world's glaciers could be lost by 2100, even if the increase in global temperatures is kept to 1.5 degrees Celsius. Despite commitments made last November by almost 200 countries to reach net-zero carbon emissions in the coming decades, international analysis forecasts that global temperatures are set to rise by at least 2.4 C above preindustrial levels by the end of the century.

That will result in much greater glacier contribution to sealevel rise and the near-complete deglaciation of entire regions, including Central Europe, Western Canada and the United States, and New Zealand, the study concludes.

For Western Canada's 15,000 glaciers, change is coming fast. A 2-degree increase in global temperature will mean many mountain ranges of Western Canada will experience nearly complete loss of glaciers, and those glaciers that remain will shrink. Although glaciers are already in retreat, the study shows the pace of irretrievable loss picks up sharply by 2040.

"After 2040, you really start to see a difference in the amount of aerial loss of glaciers not only in Western Canada, but throughout the planet," said Brian Menounos, a professor of earth sciences at the University of Northern B.C., and the Canada Research Chair in Glacier Change.

The study's authors ran simulations based on a range of changes in global temperatures.

In any of the temperature scenarios the authors modelled, there are wide-reaching consequences, from Alberta towns that rely on glacial runoff for their water supply, to the coastal wildlife dependent on salmon returns.

When in balance, glaciers gain mass in winter and lose an equal amount in the summer. But climate change has tipped the balance. Most of the glaciers that are projected to disappear this century are small – less than one square kilometre – but their loss can negatively affect local hydrology, tourism and cultural values.

The importance of glaciers to maintaining resilient watersheds was made clear last year when the south coast of B.C. experienced a lengthy and severe drought. For those rivers without glacial runoff, the consequences for aquatic life were dire.

The Englishman River on Vancouver Island is prized as a wild river that hosts every species of salmon on the coast. It depends on seasonal snow for runoff, and by midsummer and through the fall last year, the river's flow virtually stalled. The daytime temperature of the water, in places, climbed to lethal levels for young salmon. "These broad, wide pools on the lower Englishman were death chambers," said biologist David Clough.

Mr. Clough has worked on the Englishman River on Vancouver Island since 1981, and he has spent many years assisting organizations seeking to enhance and protect its salmon habitat. "I swam it, I went eyeball-to-eyeball with the salmon. It was a first love." The river system is fragile, because of industrial logging, agriculture and urban development. "There's no shock absorber," he explained.

Decades of conservation efforts were set back in the span of a year: Before last year's drought, there was the torrential rainfall from a set of atmospheric rivers in November, 2021, that wiped out the spawning beds. Between those two extreme weather events, Mr. Clough believes, roughly 60 per cent of the river's salmon production was lost.

To the northeast of the Englishman River, across the Strait of Georgia and up Howe Sound, another important salmon-bearing river fared much better. The Squamish River originates from the Pemberton Icefield, and is fed along its path by multiple glaciers. While riverbeds across southern B.C. were drying up last summer, the Squamish River was running strong.

Prof. Menounos, using the forecasts for glacier loss, expects the Squamish River will see even greater runoff in the coming decade as its contributing glaciers waste away. After that, the line trends steeply down, until it is gone.

The new study published in Science presents a more alarming picture than previous research. It underlines the urgency for more ambitious climate action to preserve these glacierized regions, he said.

Even with the most recent commitments out of the COP27 summit in November, the planet is on track to continue warming at a rate that will cause significant loss of glaciers – and all the resulting climate challenges, including sea-level rise and threats to water supply for close to two billion people.

"For some of the smallest glaciers, their fate is already sealed.

And if we don't want to see wholesale deglaciation, then we need to get our act together and reduce fossil fuel emissions to stay below 2 degrees warming," Prof. Menounos said in an interview.

Katrina Connors, director of the Salmon Watersheds Program for the Pacific Salmon Foundation, said extreme drought conditions in 2022 persisted in many B.C. rivers and streams through the peak of the salmon migration season, when millions of Pacific salmon normally return to their spawning grounds.

It will take a full life cycle of the salmon – which varies depending on the species – to see the full impact. Salmon are resilient, she said, but these events have intergenerational impacts.

"There's no doubt that salmon experienced higher levels of stress, and that stress could manifest in the next generation – we'll see them in two, three, four, five years, when the salmon come back."

While glacier-fed rivers like the Squamish are more resilient, she worries about the future. "In southern B.C., we are riding the coattails of the last glaciers we have intact, and that's going to change," she said.

"We're seeing higher glacial runoff in those areas, and that's expected to climb over the next decade." But once that's gone, freshwater salmon habitat won't be the same.

Climate adaptation work is already well under way on the Englishman River, because change has arrived already. Through the persistence of Mr. Clough and other conservationists, young trees are taking hold where ancient giants once anchored the river banks.

"It's way better than nothing," Mr. Clough said. "I'm hopeful that, even with climate change, we can be optimistic, that there are tools and knowledge that can recover this."

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